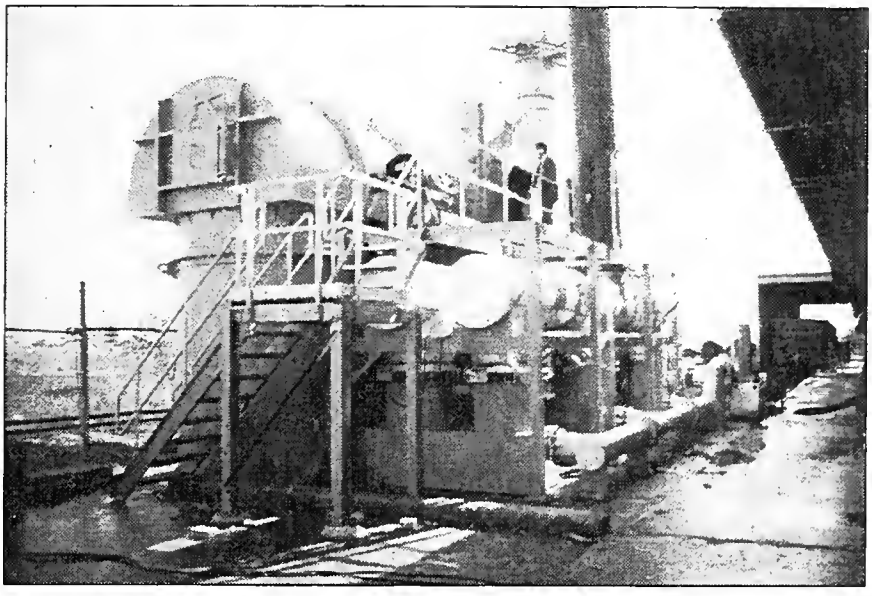
TECHNOLOGY APPLICATION

Regenerative Thermal Oxidation

"It is Ball's policy to conduct all business activities and operations in a manner which respects the environment, conforms with the laws, and promotes the commitment to be a responsible corporate citizen. With the assistance of the Ministry of Environment and Energy, we were able to adapt the Regenerative Thermal Oxidation (RTO) technology to treat the exhaust fumes from our sheet coating ovens. The high destruction efficiency and the reliability of the RTO enabled us to accomplish our environmental objective."

Allan Yee
Manager, Environmental Affairs
Ball Packaging Products Canada Inc.
Burlington, Ontario



Procedair Regenerative Thermal Oxidation (RTO)

THE CHALLENGE

Ball manufactures three piece cans at its Burlington, Ont. plant. The production process coats and cures sheets of metal in bake ovens at temperatures up to 450F (229.9C). The coated sheets are then cut to size and rolled into a cylinder. From there they are usually welded and sprayed to protect the exposed metal.

In 1990, Ball commissioned a study to evaluate the sources of the plant's emissions. According to the study, the curing ovens - where most of the solvents in the coatings evaporate - were the major source of emissions. Further, the emissions from the ovens were the likely cause of several complaints about odor which the company had received from its neighbors. Testing, however, showed that even though the concentration of volatile organic compounds (VOCs) in the oven exhaust were relatively high, they were too low to recover and recycle.

In the meantime, Ball had started evaluating new water-based coatings. These contained only 25 per cent of the solvents found in standard coatings. The water-based coatings would lower the VOC levels in the oven. But they were not a viable option for the company because too much time was required for the testing and approval of materials used in the food and beverage packaging industry.

The company's plans and its production process dictated that the abatement system had to meet several criteria. For example, it had to be efficient at destroying the VOCs regardless variations in the process and reliable to prevent unscheduled shutdowns, lost time and lower production rates. In short, the company needed a dependable and proven technology which was capable of operating continuously and had low maintenance and operating costs.

THE SOLUTION

After evaluating several options, Ball chose a 12,000 standard cubic feet per minute (scfm) RTO system. It was manufactured by Procedair Industries Inc. of Montreal, Que. and was purchased with the assistance of the Ontario Ministry of Environment and Energy. Ball installed the system in December 1992. Union Gas Limited co-ordinated the energy and emission monitoring for the project.

Procedair's RTO consists of a bank of three ceramic-packed heat exchange towers, a combustion chamber and interconnecting ductwork. The VOC-laden exhaust from the process enters the RTO through a common inlet manifold and is distributed by a valve mechanism to one of the heat exchange towers. The contaminated air is heated to near oxidation temperature as it passes through this tower.

The air then passes through the combustion chamber where the temperature is raised to and maintained at a set minimum. Natural gas burners provide any supplemental energy required. The purified air stream then passes through a second heat exchange tower where the air releases 90 to 95 per cent of its thermal energy to the ceramic packing before exiting the system through an exhaust manifold.

On the next cycle, the flow is reversed through the oxidizer. The stored thermal energy in the ceramic packing is reused to heat the inlet stream. Through the use of the valve mechanism, the heat exchange towers

change from energy storage to energy rejection with one section always on standby or purge. This allows the thermal energy to be effectively stored and released on a continual basis. The standby tower is purged of any residual contaminants which increases the RTO's destruction efficiency.

The company monitored the emissions to determine the effectiveness of the RTO on different pollutants, mixtures, concentrations, and flow rates. There were four important results.

1) Testing showed that the RTO destroyed more than 99 per cent of the total hydrocarbons, which includes VOCs, over the monitoring period.

2) Results of analysis of specific chemical groups, including aldehydes, phenolics, general organics and odor, also showed a 95 per cent or greater destruction efficiency of individual compounds.

3) The outlet concentrations of total hydrocarbons ranged from 20 to 30 parts per million (ppm) which were considerably lower than Ball's target of 100 ppm and below present requirements.

4) The nitrogen oxide emissions which were 10 ppm were also lower than present requirements as well as the severe southern California limits for industrial combustion equipment of 30 to 40 ppm.

OPPORTUNITIES

The energy or fuel used by thermal oxidizers represents a significant cost to the user while the effect on the demand for fossil fuels and the generation of greenhouse gases is a concern to everyone. As part of their analysis, ORTECH calculated the energy balance for the RTO including supplemental natural gas, electric and heat content of process exhaust.

Using this data, ORTECH estimated the supplemental energy requirements and operating costs for thermal oxidation systems at various heat recovery rates. These calculations showed expected annual energy savings of up to $90,000. Based on the incremental capital required for the higher heat recovery of the RTO, a payback period of one to three years could be expected for this application.

This technology is applicable to industrial processes such as:

* Metal finishing
* Printing
* Coating
* Laminating
* Food and beverage production
* Chemical manufacturing
* Film manufacturing
* Spray painting

FINANCIAL

Installation Period:	September - December, 1992
Monitoring Period:	January - February, 1993
Project cost:	$915,453
MOEE contribution:	$225,000
Union Gas contribution:	$15,000
Annual operating cost:	$22,305
Fuel price (1993)	$3.25/gJ*
Estimated energy savings:	
@ 50% heat recovery:	$ 90,274
@ 70% heat recovery:	$ 48,767
Project payback: *(depending on heat recovery rate)*	1 to 3 years

TECHNICAL

Manufacturer:	Procedair Industries Inc. Montreal, Quebec
Model:	12,000 scfm ReTOX System
Supplemental fuel:	Natural gas
Firing rate:	3,500,000 btu/hr*
Thermal efficiency:	89% - 95%
Destruction efficiency:	+95%

PARTNERSHIP IN POLLUTION PREVENTION AND RESOURCE CONSERVATION

Industrial companies located in Ontario may participate in ministry/industry programs that will help them to:

* reduce, reuse and recycle solid waste,
* reduce or eliminate liquid effluent and gaseous emissions
* use energy and water more efficiently.

Equipment and services supply companies can benefit from the information provided on technologies identified for business development.

FOR MORE INFORMATION, PLEASE CONTACT

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MINISTRY OF ENVIRONMENT AND ENERGY PROGRAMS

For information on Ministry of Environment and Energy assistance to industry, please contact the Industry Conservation Branch at (416) 327-1492, Fax (416) 327-1261.

**gJ is gigajoule*
btu is British Thermal Unit

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1M-10-95 PIBS 3354E12